

Claims

1. A system for loading and unloading loose cargo (6) in a cargo hold (1), preferably
5 of a plane, comprising
- transport means (14) covering the area of the floor of the cargo hold (1) for
preferably intermittently conveying the loose cargo (6) towards the inner end of
the cargo hold (1) during loading, and away from it during unloading, with the
10 front end of said transport means (14) reaching into the range of the cargo hold
opening inside the fuselage, and
- a conveyor organ (4) connecting to the cargo hold opening on the outside of the
plane for transporting the loose cargo between the level of the tarmac and the
15 cargo hold opening,
- characterized in that**
- between the plane-side end of said external conveyor organ (4) and the front end
20 of said transport means (14) in the cargo hold (1) at least one intermediate
conveyor means (2, 2', 2'', 2''', 2''''') is arranged, whereby during loading, the
loose cargo (6) may initially be conveyed deeper into the fuselage in a direction
transversal to the longitudinal axis of the plane, and subsequently be conveyed in
the longitudinal direction of the plane and deposited on the front end of said
25 transport means (14) in the cargo hold (1), and whereby during unloading, loose
cargo (6) conveyed beyond the front end of said transport means (14) into the
plane of the cargo hold opening may be transported off transversely to the
longitudinal axis of the plane through the cargo hold opening.
- 30 2. The system according to Claim 1, characterized in that the loose cargo (6) may
purposely be deposited on said transport means (14) in the cargo hold (1) during
loading, and purposely transported away from there during unloading.
3. The system according to Claim 1 or 2, characterized in that a tray (24) covering
35 the area of the floor of the cargo hold (1) and also of the floor-side range of the
cargo hold opening is arranged in the range of the cargo hold opening above the

floor of the cargo hold (1) horizontally between said intermediate conveyor means (2, 2', 2'', 2''', 2''') and the floor of the cargo hold (1).

4. The system according to Claim 3, characterized in that said tray (24) is adapted to be folded along a line parallel to the longitudinal axis of the plane.
5. The system according to any one of Claims 1 to 4, characterized in that said transport means (14) in the cargo hold (1) is a transport carpet.
6. The system according to any one of Claims 1 to 5, characterized in that said intermediate conveyor means (2, 2', 2'', 2''', 2''') comprise at least one first conveyor organ (8) adapted to be modifiable in length in the conveying direction, preferably a conveyor belt, for receiving the loose cargo (6) in the range of the cargo hold opening from the plane-side end of said external conveyor organ (4) and conveying it on transversely to the longitudinal axis of the plane during loading, wherein its end inside the fuselage is followed by another conveyor organ (10, 10', 10'', 10''', 10'''), preferably a conveyor belt, which receives the loose cargo (6) from said first conveyor organ (8) and conveys it in the longitudinal direction of the plane to the front end of said transport means (14) present in the cargo hold (1).
7. The system according to Claim 6, characterized in that said second conveyor organ (10, 10', 10'', 10''', 10''') receives loose cargo (6) from the front end of said transport means (14) present in the cargo hold (1) during unloading, transports it off in the longitudinal direction of the plane, and hands it over to said first conveyor organ (8) which conveys the loose cargo (6) transversely to the longitudinal axis of the plane to the cargo hold opening to hand it over to said external conveyor organ (4) for further transport.
8. The system according to Claim 6 or 7, characterized in that the end located inside the plane's fuselage of said first conveyor organ (8) of said intermediate conveyor means (2, 2', 2'', 2''', 2''') is linked via a shoulder to first rail having a vertical orientation in the luggage cargo hold (1), so as to be vertically slidable along it for height adjustment in the luggage hold.
9. The system according to Claim 8, characterized in that said vertically oriented first rail in turn is guided by at least one second rail having a horizontal orientation and

fastened on the ceiling or on the floor, for displacing the linking point transversely to the longitudinal axis of the plane.

- 5 10. The system according to any one of Claims 6 to 9, characterized in that said second conveyor organ (10, 10', 10'', 10''', 10''''') of said intermediate conveyor means (2, 2', 2'', 2''', 2''''') is mounted slidably relative to said first conveyor organ (8) thereof, preferably transversely to the longitudinal axis of the plane.
- 10 11. The system according to any one of Claims 6 to 10, characterized in that said second conveyor organ (10, 10', 10'', 10''', 10''''') is adapted to be modifiable in length in the longitudinal direction of the plane.
- 15 12. The system according to any one of Claims 6 to 11, characterized in that said second conveyor organ (10, 10', 10'', 10''', 10''''') comprises a sliding organ (22) that is movable in the longitudinal direction of the plane.
- 20 13. The system according to any one of Claims 6 to 12, characterized in that said second conveyor organ (10, 10', 10'', 10''', 10''''') comprises an obliquely inclinable sliding surface (28).
- 25 14. The system according to any one of Claims 1 to 13, characterized in that said intermediate conveyor means (2, 2', 2'', 2''', 2''''') or said second conveyor organ (10, 10', 10'', 10''', 10''''') comprises a gripping organ (32, 36) for grasping loose cargo (6) for unloading.
- 30 15. The system according to any one of Claims 1 to 14, characterized in that said second conveyor organ (10, 10', 10'', 10''', 10''''') of said intermediate conveyor means (2, 2', 2'', 2''', 2''''') is a conveyor belt running over a rigid slide panel (18) arranged underneath it, wherein said slide panel (18) may be inserted between two cargo items (6) jointly with the conveyor belt, and wherein the upper loose cargo may be transported off by said conveyor belt (6).
- 35 16. Intermediate conveyor means (2, 2', 2'', 2''', 2''''') for loading and unloading loose cargo (6) in cargo holds of planes, preferably for use in a system for loading and unloading loose cargo (6) according to any one of Claims 1 to 15,

characterized in that

- it comprises at least one first conveyor organ (8) adapted to be modifiable in length in the conveying direction, preferably a conveyor belt, which receives loose cargo (6) in the range of the cargo hold opening from the plane-side end of said external conveyor organ (4) during loading and conveys it on transversely to the longitudinal axis of the plane, with its end inside the plane's fuselage being followed by another conveyor organ (10, 10', 10'', 10''', 10''''), preferably a conveyor belt, which receives the loose cargo (6) from said first conveyor organ (8), and conveys it in the longitudinal direction of the plane to the front end of said transport means (14) present in the cargo hold (1).
17. Intermediate conveyor means (2, 2', 2'', 2''', 2'''') according to Claim 16, characterized in that during unloading, said second conveyor organ (10, 10', 10'', 10''', 10'''') receives loose cargo (6) from the front end of said transport means (14) present in the cargo hold (1) and transports it off in the longitudinal direction of the plane, and hands it over to said first conveyor organ (8) which conveys said loose cargo (6) transversely to the longitudinal axis of the plane to the cargo hold opening to hand it over to said external conveyor organ (4) for further transport.
18. Intermediate conveyor means (2, 2', 2'', 2''', 2'''') according to Claim 16 or 17, characterized in that the end inside the plane's fuselage of said first conveyor organ (8) of said intermediate conveyor means (2, 2', 2'', 2''', 2'''') is linked via a shoulder to a first rail having a vertical orientation in the luggage space so as to be vertically slidable along it, for height adjustment in the luggage space.
19. Intermediate conveyor means (2, 2', 2'', 2''', 2'''') according to any one of Claims 16 to 18, characterized in that said vertically oriented first rail in turn is guided by at least one second rail having a horizontal orientation and fastened on the ceiling or on the floor, for shifting the linking point transversely to the longitudinal axis of the plane.
20. Intermediate conveyor means (2, 2', 2'', 2''', 2'''') according to any one of Claims 16 to 19, characterized by at least one of the features in accordance with Claims 10 to 15.
21. A system for loading and unloading loose cargo in a cargo hold (100), preferably of a plane, comprising

transport means (102) covering the area of the floor of the cargo hold (100) for preferably intermittently conveying the loose cargo towards the inner end of the cargo hold (100) during loading, or away from it during unloading, wherein the
5 front end (120) of said transport means (102) reaches into the range of the cargo hold opening (104) inside the fuselage, and

a conveyor organ (108) connecting to the outside of the plane at the cargo hold opening for transporting the loose cargo between the level of the tarmac (110) and
10 the cargo hold opening (104),

characterized in that

between the plane-side end of said external conveyor organ (108) and the front
15 end (120) of said transport means (102) in the cargo hold (100) at least one intermediate conveyor means (112) is arranged, whereby the loose cargo may during loading initially be conveyed deeper into fuselage substantially transversely to the longitudinal axis of the plane, and

whereupon the loose cargo may then be rotated manually in the cargo hold (100)
20 and transported further substantially in the longitudinal direction of the plane and deposited on the front end (120) of said transport means (102) in the cargo hold (100), and

whereby during unloading, loose cargo conveyed beyond the front end (120) of
said transport means (102) out into the plane of the cargo hold opening (104) may
25 be transported off substantially transversely to the longitudinal axis of the plane through the cargo hold opening (104).

22. The system according to Claim 21, characterized in that it includes at least one of
the features of the system in accordance with at least one of Claims 1 to 5.
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23. The system according to Claim 21 or 22, characterized in that said intermediate
conveyor means (112) includes a sliding element, preferably a wheel, at its lower
side in the overlap range (122) with said external conveyor organ (108), for
slidably supporting said intermediate conveyor means (112) on the upper side
35 (124) of said external conveyor organ (108) in the end range thereof.

24. The system according to any one of Claims 21 to 23, characterized in that in the overlap range (122) with said external conveyor organ (108) an outrigger (126) is linked to said intermediate conveyor means (112), which is supported by its end facing away from said intermediate conveyor means (112), by means of an articulation linked there, against a sliding rail (128) oriented in parallel with the longitudinal direction of said external conveyor organ (108) and fastened to the latter, for slidably supporting said intermediate conveyor means (112) in the conveying direction of said external conveyor organ (108).
25. The system according to any one of Claims 21 to 24, characterized in that the end (118) of said intermediate conveyor means (112) facing the front end (120) of said transport means (102) in the cargo hold (100) is adjustable in height relative to the beginning (116) of said intermediate conveyor means (112) facing said external conveyor organ (108).
26. The system according to any one of Claims 21 to 25, characterized in that an end portion (132) of said intermediate conveyor means (112) is capable of being pivoted about an axis (134) transversely to the conveying direction of said intermediate conveyor means (112), such that this end portion (132) may be oriented horizontally.
27. The system according to any one of Claims 21 to 26, characterized in that a leading portion (136) of said intermediate conveyor means (112) is oriented at a predetermined angle of inclination, preferably between 10° to 30°, with the angle of inclination of said external conveyor organ (108).
28. The system according to any one of Claims 21 to 27, characterized in that said intermediate conveyor means (112) including its conveying direction for conveying loose cargo substantially transversely to the longitudinal axis of the plane may be pivoted about an angular range of about -30° to +30° relative to the conveying direction of said external conveyor organ (108).
29. The system according to any one of Claims 21 to 28, characterized in that parts of the supporting structure of said intermediate conveyor means (112) are manufactured of lightweight materials, such as aluminum or fiber composites.

30. Intermediate conveyor means (112) for loading and unloading loose cargo in cargo holds of planes, preferably for use in a system for loading and unloading loose cargo according to any one of Claims 1 to 15 or according to any one of Claims 21 to 29,
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- characterized in that**
- said intermediate conveyor means (112) comprises at least one first frame (138) supported against an external conveyor organ (108) with a first conveyor organ (140), preferably a first conveyor belt,, for receiving the loose cargo during loading, preferably in the range in front of the cargo hold opening (104) of the plane, from the end (122) of said external conveyor organ (108) facing the plane, and conveying it on substantially transversely to the longitudinal axis of the plane, wherein the end (142) of said first conveyor organ (140) is followed by a second conveyor organ (144), preferably a second conveyor belt, preferably for bridging the distance from the end (122) of said external conveyor organ (108) to the inside of the cargo hold (100), for receiving loose cargo during loading, preferably in the range of the cargo hold opening (104) of the plane, from the end (142) of said first conveyor organ (140), and conveying it on substantially transversely to the longitudinal axis of the plane,
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- wherein the end (146) thereof is followed by a third conveyor organ (148), preferably a roller panel, for receiving loose cargo during loading from the end (146) of said second conveyor organ (144) and permitting manual rotation of the loose cargo located thereon, such that the loose cargo may be conveyed on substantially in the longitudinal direction of the plane to the front end (120) of transport means (102) present in the cargo hold (100).
31. Intermediate conveyor means (112) according to Claim 30, characterized in that during unloading, loose cargo may be applied manually on said third conveyor organ (148) from the front end (120) of said transport means (102) present in the cargo hold (100) substantially in the longitudinal direction of the plane, rotatably placed there, and supported suitably for handover to said second conveyor organ (144), wherein said second conveyor organ (144) conveys the loose cargo substantially transversely to the longitudinal axis of the plane to the cargo hold opening (104) and/or through the latter and hands it over to said first conveyor organ (140), which conveys the loose cargo on substantially transversely to the
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longitudinal axis of the plane to said external conveyor organ (108) and hands it over to the latter for further transport.

- 5 32. Intermediate conveyor means (112) according to Claim 30 or 31, characterized in that said frame (138) of said first conveyor organ (140) comprises a sliding element, preferably a wheel, at its lower side for a slidable support of said first conveyor organ (140) substantially in the conveying direction of said external conveyor organ (108) on the upper side (124) of said external conveyor organ (108) in the range of the end portion (122) thereof facing the plane walls.
- 10 33. Intermediate conveyor means (112) according to any one of Claims 30 to 32, characterized in that on said frame (138) of said first conveyor organ (140) an outrigger (126), preferably an outrigger having two arms, is linked with is supported by its end facing away from said frame (138), via an articulation linked there, against a sliding rail (128) which is oriented in parallel with the longitudinal direction of said external conveyor organ (108) and fastened to the latter, for slidable support of said external conveyor organ (108) of said first conveyor organ (140) substantially in the conveying direction on said external conveyor organ (108).
- 15 34. Intermediate conveyor means (112) according to any one of Claims 30 to 33, characterized in that said second conveyor organ (144) is linked to said frame (138) of said first conveyor organ (140) such that it may be pivoted about an axis (154) transversely to the conveying direction, preferably about an angular range of -15° to +45°, for modifying the height of the end (146) of said second conveyor organ (144) relative to its beginning.
- 20 35. Intermediate conveyor means (112) according to any one of Claims 30 to 34, characterized in that said third conveyor organ (148) is linked to the end (146) of said second conveyor organ (144) such that it may be pivoted about an axis (134) transversely to the conveying direction of said second conveyor organ (144), so that it may be oriented horizontally.
- 25 36. Intermediate conveyor means (112) according to any one of Claims 30 to 35, characterized in that said first conveyor organ (140) with its frame (138) is pivotally supported on said external conveyor organ (108) such that a degree of pivoting said intermediate conveyor means (112) about an angular range of about
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–30° to +30° relative to the conveying direction of said external conveyor organ (108) may be selected.

5 37. Intermediate conveyor means (112) according to any one of Claims 30 to 36, characterized in that said second and/or third conveyor organ (144, 148) is associated with elements supporting the lifting, lowering, or pivoting movements thereof, such as, e.g., a parallelogram linkage arranged on either side of the edges of a conveyor organ, for supporting a lifting, lowering, or pivoting movement, so that such movements may be predetermined by a person working in the cargo hold
10 (100) approximately free of effort.

15 38. Intermediate conveyor means (112) according to any one of Claims 30 to 37, characterized in that in the range of said third conveyor organ (148) a multi-function operating element is provided, whereby for instance the horizontal orientation of said third conveyor organ (148), the inclination of said second conveyor organ (144), the position of said first conveyor organ (140) on said external conveyor organ (108), the conveying direction, the conveying velocity, or further functions may be controlled.

20 39. Intermediate conveyor means (112) for loading and unloading loose cargo in cargo holds of planes, preferably for use in a system for loading and unloading loose cargo according to any one of Claims 1 to 15 or according to any one of Claims 21 to 29,

25 **characterized in that**

said intermediate conveyor means (112) comprises at least one first frame (138) supported against an end portion of an external ground-supported conveyor organ reaching from outside into the cargo hold of the plane, with a first conveyor organ
30 (140), preferably a first conveyor belt, for receiving loose cargo during loading from the end portion of said ground-supported conveyor organ and conveying it on,

wherein the end (142) of said first conveyor organ (140) is followed by a second conveyor organ (144), preferably a second conveyor belt, preferably for bridging
35 the distance from the end portion of said ground-supported conveyor organ to the location of deposition of the loose cargo in the cargo hold (100), which receives

loose cargo from the end (142) of said first conveyor organ (140) during loading and conveys it on,

wherein the end (146) thereof is followed by a third conveyor organ (148), preferably a roller panel, which receives loose cargo from the end (146) of said second conveyor organ (144) during loading and permits a manual rotation of the loose cargo rotatably placed thereon, such that the loose cargo may be conveyed on substantially in the longitudinal direction of the plane to the location of deposition of the loose cargo in the cargo hold (100).

40. Intermediate conveyor means (112) according to Claim 39, characterized in that during unloading, loose cargo may be applied manually from its location of deposition in the cargo hold (100), preferably substantially in the longitudinal direction of the plane, on said third conveyor organ (148), rotatably placed there and supported suitably for handing over to said second conveyor organ (144), wherein said second conveyor organ (144) conveys the loose cargo on and hands it over to said first conveyor organ (140), which conveys the loose cargo on to the end portion of the ground-supported conveyor organ reaching from outside into the cargo hold (100) of the plane and hands it over to the latter for further transport.

41. Intermediate conveyor means (112) according to Claim 39 or 40, characterized in that it includes at least one of the features of the intermediate conveyor means (112) in accordance with at least one of Claims 30 to 36.

42. Intermediate conveyor means (112) according to any one of Claims 39 to 41, characterized in that said second and/or said third conveyor organ (144, 148) is associated with elements supporting the lifting, lowering, or pivoting movements thereof, such as, e.g., a parallelogram linkage arranged on either side of the edges of a conveyor organ for supporting a lifting, lowering, or pivoting movement, so that the like movements may be predetermined by a person working in the cargo hold (100) approximately free of effort.

43. Intermediate conveyor means (112) according to any one of Claims 39 to 42, characterized in that in the range of said third conveyor organ (148) a multi-function operating element is provided, whereby for instance the horizontal orientation of said third conveyor organ (148), the inclination of said second conveyor organ (144), the position of said first conveyor organ (140) on said

external conveyor organ (108), the conveying direction, the conveying velocity, or further functions may be controlled.

- 5 **44.** Intermediate conveyor means (112) according to any one of Claims 39 to 43, characterized in that the loose cargo (6) in the cargo hold (1) may purposely be deposited at the location of deposition during loading, and purposely be conveyed away from there during unloading.
- 10 **45.** Intermediate conveyor means (112) according to any one of Claims 39 to 44, characterized in that said third conveyor organ (148) comprises a movable sliding organ (22).
- 15 **46.** Intermediate conveyor means (112) according to any one of Claims 39 to 45, characterized in that said third conveyor organ (148) comprises an obliquely inclinable sliding surface (28).
- 20 **47.** Intermediate conveyor means (112) according to any one of Claims 39 to 46, characterized in that said third conveyor organ (148) comprises a gripping organ (32, 36) for grasping loose cargo (6) for unloading.
- 25 **48.** Intermediate conveyor means (112) according to any one of Claims 39 to 47, characterized in that said third conveyor organ (148) comprises a conveyor belt running over a rigid slide panel (18) arranged underneath it, wherein said slide panel (18) may be inserted between two cargo items (6) jointly with the conveyor belt, and wherein the upper loose cargo may be transported off by said conveyor belt (6).
- 30 **49.** Intermediate conveyor means (112) according to any one of Claims 39 to 48, characterized in that sensors, cameras, control circuits, artificial intelligence or the like communicating with said intermediate conveyor means (112) are provided.
- 35 **50.** A conveyor unit for loading and unloading loose cargo (6), such as preferably pieces of luggage in a cargo hold (1, 100, 200) of a plane, whereby loose cargo (6) supplied from outside the plane from the tarmac level to the cargo hold opening and through the latter into the cargo hold (1, 100, 200) may be conveyed further into the cargo hold (1, 100, 200),

comprising a first conveyor organ (204) for transporting the loose cargo in the cargo hold (1, 100, 200),

5 whereby loose cargo (6) supplied from outside the plane during loading of the cargo hold (1, 100, 200) may be conveyed in the cargo hold (1, 100, 200) into the fuselage into the range of a location of deposition both transversely and longitudinally to the longitudinal axis of the plane,

10 and whereby loose cargo (6) may be conveyed back during unloading from the range of the location of deposition into the plane of the cargo hold opening, so that the loose cargo (6) may from there be transported off to the outside transversely to the longitudinal axis of the plane through the cargo hold opening,

characterized in that

15 the end (250) of said first conveyor organ (204) located inside the fuselage in the cargo hold (1, 100, 200) is horizontally slidable or pivotable transversely to the longitudinal axis of the plane and comprises a subsequent second conveyor organ (2, 112, 144, 244) having a subsequent third conveyor organ (10, 148, 248), with
20 these being linked such that a height adjustment of said third conveyor organ (10, 148, 248) in the cargo hold (1, 100, 200) may be achieved by an adjustment of the inclination of said second conveyor organ (2, 112, 144, 244),

25 and that during loading, the loose cargo (6) may purposely be deposited on the desired location of deposition in the cargo hold (1, 100, 200) by said third conveyor organ (10, 148, 248) - powered by conveyor means (262) of said third conveyor organ (10, 148, 248) or automatically - and during unloading purposely picked up and transported off by said third conveyor organ (10, 148, 248) -
30 powered by conveyor means (262) of said third conveyor organ (10, 148, 248) or automatically.

51. The conveyor unit according to Claim 50, characterized in that said second and/or third conveyor organ (2, 10, 112, 144, 148, 244, 248) is associated with elements supporting the lifting, lowering, or pivoting movements thereof (256), such as,
35 e.g., a powered parallelogram linkage arranged on either side of the edges of the conveyor organ, a spring-loaded cylinder or the like, such that the like movements

may be predetermined by a person (258) working in the cargo hold (1, 100, 200) approximately free of effort.

- 5 **52.** The conveyor unit according to Claim 50 or 51, characterized in that a multi-function operating element (260) is provided, whereby, e.g., the horizontal orientation of said third conveyor organ (10, 148, 248), the inclination of said second conveyor organ (2, 112, 144, 244), the position of said first conveyor organ in the cargo hold (1, 100, 200), the conveying direction, the conveying velocity, or further functions may be controlled.
- 10 **53.** The conveyor unit according to any one of Claims 50 to 52, characterized in that said conveyor means (262) of said third conveyor organ (10, 148, 248) is a conveyor belt running over a rigid slide panel (18, 264) arranged underneath it.
- 15 **54.** The conveyor unit according to any one of Claims 50 to 53, characterized in that a deflection roller (268) of said conveyor belt (262) facing the loose cargo (6) has such a small diameter that the tip (266) of said third conveyor organ (10, 148, 248) has the shape of a spatula or tongue.
- 20 **55.** The conveyor unit according to any one of Claims 53 or 54, characterized in that the coefficient of friction μ between at least a part of the loose cargo (6) and at least a part of the surface facing the loose cargo of the conveyor belt is more than 0.50, preferably more than 0.60, and in a particularly preferred manner more than 0.70.
- 25 **56.** The conveyor unit according to any one of Claims 53 to 55, characterized in that the conveyor belt has on its surface thereof facing the loose cargo friction-increasing means, such as preferably roughings, studs, ribs, or the like.
- 30 **57.** The conveyor unit according to any one of Claims 50 to 56, characterized in that automatic control systems (270) communicating with the end of said first conveyor organ (204) located in the cargo hold and/or with said second conveyor organ (2, 112, 144, 244) and/or with said third conveyor organ (10, 148, 248) are provided, such as, e.g., sensors, cameras, control circuits, artificial intelligence, or
- 35 the like.

58. The conveyor unit according to any one of Claims 50 to 57, characterized in that it includes at least one of the features of Claims 1 to 49.